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are given for comparison the results of an analysis of a mica from Hirschburg, taken from Dana's System of Mineralogy, last edition, and classed by him among the muscovites.

	I.	II.	III.
SiO_2	48.95	26.11	49.04
Al_2O_3	25.17	11.73	29.01
Fe_2O_3	9.40	2.82	5.56
MgO	1.69	0.67	0.75
CaO	trace.	. . .	0.17
Na_2O	trace.	. . .	0.50
K_2O	11.08	1.88	11.19
H_2O	4.31	3.83	4.65
	100.60		100.87

Oxygen Ratios. — Bases with water to silica are as 4 : 5 nearly. Bases without water to silica are as 2 : 3 approximately.

$$RO + H_2O : R_2O_3 : SiO_2 = 5 : 11 : 20.$$

$$RO : R_2O_3 : SiO_2 = 2 : 11 : 20.$$

Conclusions. — Here, then, we have an evident product of alteration, with some of the characters of a vermiculite, which differs in composition from ordinary muscovite mica only in the absence of fluorine, and the presence of a somewhat larger amount of magnesia. Possibly muscovite may pass into vermiculite, and this mica from Texas may represent the first step in the alteration; but if so, intermediate stages must be found, and then this work may help to answer the question. As will be seen, the composition of the Texas mica agrees closely with that of the mica from Hirschburg, the difference in the relative amounts of Al_2O_3 and Fe_2O_3 being unessential.

II. — ANALYSIS OF A CRYSTALLINE SCALE FORMED IN THE MANUFACTURE OF SODIC BICARBONATE BY THE AMMONIA PROCESS, AT SYRACUSE, N. Y.

By George W. Leighton, B. S. 1886.

The material here described was deposited on the inner surface of an iron tank in which vapors consisting of NH_3, CO_2, with small quantities of H_2S, are passed through brine holding in solution NaCl, $MgCl_2$,

$CaCl_2$, and $CaSO_4$. It has the appearance of a boiler scale from one to two inches thick, semitransparent, with a vitreous lustre and of greenish gray color, although sometimes black on the surface. The scale is usually covered with crystal planes, which have at first sight the appearance of octahedral forms projecting from the surface, but on closer examination the planes were found to be the terminations of prisms extending down into the body of the scale. The faces were somewhat curved, and so irregular as to render accurate measurements with the reflecting goniometer impossible. Attempts were made to obtain approximate values by cementing to the faces bits of thin microscope glass, but the results were discordant. The crystals seemed to have a monoclinic habit, and to consist of an oblique rhombic prism terminated by two pairs of planes of the positive and negative hemioctahedrons. For the prismatic angle we obtained 57° 46′, and for the positive and negative octahedral angles an average of 69° and 75° respectively, but with a variation of more than three degrees between measurements on different crystals. We observed a well-marked cleavage parallel to the assumed plane of symmetry; also a second cleavage — inclined to the prismatic edges, and marked by striations on the prismatic planes — parallel to the assumed basal section. There were also indications of both ortho- and clino-domes; and from these features, as well as from the mode of twinning, it is highly probable that the crystallization is monoclinic, but the evidence is not conclusive.

A qualitative analysis showed that the material was composed chiefly of sodium and magnesium in combination with carbonic acid and chlorine, with a small amount of calcium, and a trace only of iron. The scale when pulverized was decomposed by water, all of the sodium salts and part of the magnesium passing into solution upon digestion with a sufficiently large volume of boiling water, but from this solution all the magnesium was thrown down on concentration as carbonate.

In the quantitative analysis, the alkali was determined in two ways; first, by extraction of the sodium salts with water, and the separation of the magnesium by concentration; secondly, by the regular Lawrence Smith method; and concordant results were thus obtained. The magnesium, calcium, and iron were separated in the usual way. Chlorine was determined by precipitation with argentic nitrate from a solution of the scale in nitric acid, and the CO_2 was determined by loss on treating with acid in a small apparatus adapted for the purpose, and also by absorption in potash bulbs. The results are given below.

Substance estimated.	Number of Analysis.							
	1	2	3	4	5	6	7	8
H_2O at 100° C.					0.31	0.39	0.395	
H_2O at 230° C.	0.63	0.63						
CaO			2.02	1.99	1.96	1.96	2.05	
FeO	0.045	0.054						
MgO			14.90	14.77		15.34	15.12	
Na_2O	38.71		38.45	38.57				
Cl	13.45		13.46	13.45				
CO_2	36.24			35.33	35.65	35.46		35.54

Taking now the means of these determinations, and assuming that the chlorine is combined with sodium, while the carbonic acid is distributed among the rest of the base, we obtain as the final average result of the analysis: —

	Found.	Theory.	Diff.
NaCl	22.230	22.23	
Na_2CO_3	40.622	40.28	—0.34
$MgCO_3$	31.569	31.92	+0.35
$CaCO_3$	3.559		
$FeCO_3$	0.080		
H_2O	0.630		
CO_2 in excess	0.645		
	99.335		

It will be noticed that CO_2 is present in slight excess over the amount required to form neutral carbonates, indicating a small admixture of bicarbonate. The water is obviously hygroscopic, and the minute amount of iron an impurity. Excluding also from consideration the small amount of lime whose relations to the mass cannot certainly be determined, it appears that the three chief ingredients of the crystalline scale are present very closely in the proportion of their molecular weights. This is shown in the column headed Theory, which gives the amounts of Na_2CO_3 and $MgCO_3$ corresponding to the amount of NaCl found in the material analyzed, on the assumption that this is a triple salt represented by the symbol $MgCO_3 . Na_2CO_3 . NaCl$.

By comparing the determinations of chlorine which form the basis of this calculation, it will be seen that the amount of NaCl must be known with great accuracy, and the column of differences shows that the calculated values of $MgCO_3$ and Na_2CO_3 differ from results of analysis within the limits of experimental errors. By withdrawing from the total weight the small amount of base assumed to exist as bicarbonate, corresponding to the excess of CO_2 shown by analysis, and making also the very probable assumption that the calcium found replaces the magnesium in the triple salt, we should obtain very nearly the same results as before; but such a calculation would rest on uncertain data, and add nothing to the strength of our general conclusion.

It is evident that the crystalline scale is a double carbonate of magnesium and sodium united in molecular proportions with common salt, and mixed with a small amount of impurity; but the amount of impurity is very small, considering the conditions under which the scale is formed. That the chloride is combined, and not simply mixed, with the carbonate, is shown, not only by the definite proportions, but also by the fact that the material is so slowly acted on by water, which evidently acts as a decomposing agent, and not solely as a solvent. The scale is then a definite crystalline product, having a very interesting constitution not unlike that of several well defined mineral species.

III.—ON THE CONSTANCY IN THE HEAT PRODUCED BY THE REACTION OF ARGENTIC NITRATE ON SOLUTIONS OF METALLIC CHLORIDES.

By Theodore W. Richards, A. B. 1886.

Having observed in some experiments made solely for practice that the heat produced by the precipitation of silver chloride from aqueous solutions of several metallic chlorides was directly proportional to the amount of silver nitrate used, the following investigation was made in order to determine whether this relation was really exact.

A standard solution of argentic nitrate was prepared by dissolving 100 grams of $AgNO_3$ in one litre of water, and diluting to 1250 cc. 50 cc. of this solution diluted to just 250 cc. were used in each determination (except once when twice that amount was used), and the solutions of the various chlorides were made up so that 250 cc. would contain a gram or so more salt than was necessary to precipitate the quantity of silver nitrate used.